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RURAL DEVELOPMENT THROUGH ELECTRONIC TECHNOLOGY*

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Rural development is viewed as a process of improving the quality of life of rural residents. Quality of life has a number of aspects, but the economic is viewed as a particularly strategic one for promoting overall life quality. The economic is defined as providing jobs for rural residents. Two techniques for doing this, inducing firms to locate in rural areas and rural residents' commuting to jobs in urban centers contain economic disadvantages. An alternative is to have rural residents work at home and send the effort of their work to firms in urban centers via electronic communications systems. This alternative depends on the distinction between jobs and firms. It also depends on being able to view many jobs as essentially consisting of information processing. The input to and output from the rural worker flows over a national network termed the "total electronic information system".

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RURAL DEVELOPMENT THROUGH ELECTRONIC TECHNOLOGY[1]

I. Introduction

The term "rural development" is a controversial one and this controversy has two dimensions.[2] Some prefer the term community improvement or community development. Others would accept the term but disagree over its meaning or over the main thrust of a rural development effort. For example, some would say that rural development means improving the quality of life of rural residents. Others would contend that rural development is economic development of rural areas. Finally, one could ask what is meant by the term "rural". Is rural defined according to the mean population density of an area or according to the attitude of its citizens?

For purposes of this paper, rural development will be taken to mean improving the quality of life of those living in rural areas. The term rural areas will mean areas of comparatively low population density, although such an area might include one or more towns of several thousand people. In assigning this meaning to the term it is not intended to convey that this is the "correct" definition and the best term but only to clarify the meaning in the context of this paper.

II. Economics and the Quality of Life

The term "quality of life" has a number of definitions and aspects. Quality of life includes environmental quality (the ecological), the economic, social, cultural, recreational and civic services. If any of these aspects are improved without at the same time causing a decline in

another aspect then there is a net gain in the quality of life. Given attempts to improve one aspect might at the same time produce a decline in another aspect. An obvious example is a possible conflict between economic and environmental quality.

Different aspects of life quality can, of course, also compete for the resources devoted to development. If efforts are devoted to improving one aspect of life quality they are not available for use in improving the other aspects. However, an improvement in one aspect may have the effect of improving other aspects. For example, if an area improves its educational system and civic services this might attract a new industry, thus indirectly causing economic improvement.

The converse is also very likely. If an area experiences an economic improvement, this might generate the resources necessary to improve the other aspects of its life quality. Economic growth means an increase in the tax base and thus increases the ability to provide civic services. (It might also increase the demand for such services.) Increased income also makes local citizens more able and more willing to patronize cultural activities. Finally, it generates new sales of local consumer services and demands for recreational activity. Such increases in patronage and sales may make it possible for a local entity to start providing the service instead of the citizens having to go elsewhere or do without.

Delineating the various relationships between the various aspects of life quality points out the need for a strategy of rural development. A key element in this strategy is the economic. If economic growth can generate the ability and willingness to improve other aspects of life quality then

economic growth is a key point on which to focus one's effort. This assumes that economic growth can be achieved without lowering other aspects of life quality (i.e. the environmental).[3] Choosing to focus on the economic is particularly strategic.[4] It doesn't imply that it is the only or ultimate goal of rural development. Such a strategic choice does, however, represent a compromise between those who view rural development as economic development and those who view it as an attempt to improve the quality of life.

This paper will also offer a second dimension to this compromise. It will propose a technique of economic development which can also be used to improve certain other aspects of the quality of rural life and which has little or no adverse environmental effects.

III. Economic Development and Incomes

The goal of economic development is to provide income for rural citizens. One usually thinks of agriculture as being the primary source of rural income. For many decades, however, capital and chemicals have been replacing labor and land in agriculture. This trend is unlikely to change significantly. Indeed, less than five percent of the U.S. labor force is engaged in agriculture and many of these are only partly employed in it. As employment declines in agriculture, towns in rural areas whose main function was serving the surrounding agricultural population also experience declining incomes. The rural resident's response has traditionally been to move to urban areas and seek jobs in industries.

Migration to urban areas decreases the number of customers for services in rural areas. This leads to the inability to provide such services.

Declines in services further lower the quality of rural life inducing further immigration and thus setting up a vicious circle. Conversely, a dollar earned by a rural resident from making a product used outside his area will generate several dollars in local income as it is spent on local services and those who receive it in turn spend it. This is the well-known multiplier effect and it works in both directions.

The key to generating a desirable multiplier effect is to have jobs for local residents which produce products sold outside the area. Since agriculture is increasingly unable to provide such jobs one naturally thinks of industry as the only alternative. (This assumes one is ruling out a simple income transfer from urban to rural areas.) This in turn leads one to think of inducing industrial firms to locate in rural areas. Thus rural development and inducing industry to locate in rural areas becomes synonymous in the speech (and in the thoughts) of many.

One must remember, however, that firms locate in particular areas because there are economic advantages to doing so. Urban areas, by their nature, offer two significant advantages. One is a large labor force containing a large number of diverse skills. A second is good transportation. A firm must be able to get its raw material in and to ship its products to a wide market. The cost of such transportation must be competitive with the transportation cost of other firms in its industry. This is particularly true of bulk items such as industrial raw material.

The importance of these advantages vary for different industries and thus in fact some firms do locate in rural areas. But a rural area seeking to attract plants must usually overcome such disadvantages and it can only

do so by creating counter advantages in the form of direct or indirect subsidies. These may take the form of low interest loans, favorable tax treatment or subsidizing a more extensive, bulk cargo transportation system. But whatever the form, it is a subsidy and thus costs the area citizens money.

IV. Jobs vs. Firms

To begin to get around the difficulty outlined above one must start by making a basic distinction: the distinction between jobs and firms. The real goal of rural development strategy is to provide jobs (i.e. income) for rural residents. A firm located in a rural area could provide such jobs but this is only one source of such jobs. Inducing firms to locate in rural areas is only one alternative in providing jobs for rural residents. Thus one may make the distinction between an individual's job and the firm for which the individual works. In what follows the distinction between jobs and firms is crucial.

One might contend that this distinction, although conceptually valid, has no operational significance. This argument would contend that an individual's job was with a firm and that he must be at that firm's place of business to fulfill it. Thus the conceptual distinction, while valid, has no operational significance.

There are obvious exceptions to this; the salesman is one. But of greater significance is the case of the commuter. In this case the individual holds a job which is in one place and lives in another. The individual certainly doesn't have to live near the firm for which he works. One could

still contend, however, that the job is still at the firm and this is shown by the act of commuting.

Commuting as a solution for unemployment in rural areas is limited, however. Some do live in rural areas and commute to a job in an urban area. But this is possible only for rural areas close to an urban center. The radius of commuting could be increased by building better freeways or by mass transit. Any transportation grid which would access all or most of the thinly populated rural areas would be very costly. A freeway system would, if successful in inducing rural residents to drive so far, substantially increase the congestion at rush hours. Public transit through a sparsely settled area would require high fares in order to be self-supporting. This would not encourage usage. Thus commuting is not a practical alternative for most rural areas.

V. Products, Services and Information

The distinction between jobs and firms becomes significant if one conceives of individuals working where they live and sending the results of their effort to the firm employing them, the firm being located in an urban area. If the results of the individual's labor are a physical item, then this is possible but hardly economical. The cost of transporting raw or semi-finished material to the worker's home and transporting the product to the firm is prohibitive. This process would also involve the losses due to not being able to apply specialization and division of labor on such an intensive scale.

But if the results of the individual's effort were not physical products then it becomes possible for him to work at home and transport his efforts to

a distant firm. How can this, in fact, be done? If an individual is not directly involved in making a product, he must, of course, be producing a service. This is obvious if the firm is one whose product is a service, such as an insurance company. What about a goods-producing company? If one examines closely the total number of employees in a firm producing a product one discovers that many, perhaps a majority, are not directly engaged in producing the product. They are occupied performing services which support or aid those who are actually reacting with raw material and capital to make the product. This service group which supports the "production" workers are engaged in such activities as accounting, personnel, payroll, advertising, public relations, design, engineering and research, management, credit, customer relations, finance and data processing.

It is well known that the majority of the American labor force is engaged in producing services, not goods. It is not realized that many of those who work for goods-producing firms are not directly engaged in producing goods but instead produce services. With the coming of automation nothing but a cybernated control system may be directly engaged in making a product. Those who monitor the system do not directly produce the product. They are engaged in the service of monitoring and, when necessary, of control and correction. The trend toward a service economy would seem to work against having employees fulfill their duties at home and transport the results of their effort to their firm. It may be uneconomical to transport products this way, but they at least <u>can</u> be transported. One thinks of services as being immediately consumed on the spot by the one receiving them. This usually requires that the producer and consumer be in close proximity.

But one type of service does not require close physical proximity. One might also view it as a product which could be easily transported. The product is information and the service is information processing.[5] Many services, when examined closely, are discovered to be information-processing activities. All those who work in offices are basically performing information processing. In order to be able to recognize information-processing activities, one must know what the basic steps in the process are. Information processing consists, essentially, in the following sequence: (1) Information is received by an individual; (2) using this information and his own experience and extertise as well as other information available to him, he forms judgments; (3) the judgments may be used to modify the received information, generate new information, select existing information or any combination of these three; (4) the judgments (which are themselves information), the modified and/or new information is transported to others.

All processes or activities which can be viewed as essentially consisting of the above four steps can be considered as information processing. Only two of these, the second and the third, are true processing. The first and fourth are transportation of information. At this point one comes to the crucial importance of one characteristic of information for rural development. Information can exist in the mind of an individual. But if it is to be transported between individuals it must be embodied in some physical medium. One type of medium is print. This medium allows for fairly inexpensive transportation and for bulk storage. But an even more efficient medium for inexpensive transportation is the electronic.

VI. Electronic Transportation

The electronic media transport information at close to the speed of light. This makes it possible for an individual engaged in information processing to work at home. He may receive information from some distant point, think about the information and form judgments, modify and/or generate new information and send it to some distant point. Since the transportation steps (the first and fourth) occur at a speed near that of light, the entire process could occur many times a day. The cost of electronic transportation is very low. The advantages of specialization and division of labor are not lost. The information transported can be specialized information between those performing specialized, sequential functions. In this way the labor of a given job of information processing can be divided.

The key to this rests in two aspects of electronic communications: it is, for all practical purposes, instantaneous, and a large amount of information can be sent very cheaply. Information, embodied in electromagnetic impulses, can be transported in a number of ways. These include radio, microwave, cable and laser. The electronic impulse can be propagated in a spherical field about the source (such as in radio or broadcast TV). This is the least efficient, costs the most to transport large amounts of information (if each is receiving different information) and would soon crowd the electromagnetic spectrum. A second approach is to concentrate the impulse in a narrow beam (such as by microwave or laser). This allows more information to be carried by the electromagnetic spectrum and usually results in

more capacity. The capacity of an impulse is directly proportionate to its frequency, and microwave and lasers have a higher frequency than radio or electric current. The final approach is to send the impulse through a conduit. This might be electricity sent through a cable or a laser beam sent through an empty pipe. The conduit approach allows hugh amounts of information involving conversations between many pairs of points to be carried simultaneously. The narrow beam or the conduit would be true high capacity electronic "highways" for transporting high "volume", low cost information. Along these electronic highways rural residents could "commute" (or have their information "commute") to firms in urban areas.

With a national system of such electronic "highways", a given individual could live in any community he chose and work for a firm in any city. One could probably imagine how electronic transportation systems of high capacity would be economically justifiable between large urban areas. One might even conceive of electronic "highways" between an urban center and larger towns in rural areas. But is an electronic highway to every home in a sparsely settled rural area economically feasable? Two such systems already exist.[6] These are the telephone system and the electric power system. Electricity is a form of electromagnetic energy. The connection between energy and information has already been demonstrated.[7] The telephone system is, of course, a system for the transportation of information embodied in electromagnetic impulses. The telephone wire doesn't have the ability to carry substantial volumes of information but it would be sufficient for one individual. One can imagine a rural resident making a local call to a nearby town. In the town his information is automatically fed into a microwave

system which connects the town to an urban center. The microwave line could carry simultaneously the telephone communications of several hundred or several thousand rural residents in and around the town.

A wire system with higher transmission capability is probably desirable for reasons that will be outlined later. Such a system is already being built. It consists of the wires of cable television systems. These systems are particularly prominent in rural areas. Over five million homes in the U.S. are connected to a cable system of some kind. By 1980 it is projected that 40% to 60% of American homes will be connected to some type of cable system.[8] Most cable systems have forty-channel capacity. Only a few of the channels are actually utilized. The rest are for future expansion of services. These vacant channels could easily provide enough capacity to transmit vast amounts of information. It should be emphasized that all channels which are used in transmission are received in the home. Since a TV can present only one channel at a time, the viewer selects the one to be shown on the screen by the channel selector. But all channels actually transmit to the TV at the same time. A single cable could easily present a different channel on three TV's in each room of a twelve room house. Cables of higher capacity can carry eighty channels and two-way conversation and pictures, making multiperson-multireceiver conferences possible.[9]

VII. Computer Terminals in the Home

Once the information can be transmitted into rural homes at the speed of light, in high volume and cheaply, how can it be utilized by the employee? The answer is to have the cable attached to a computer terminal

in the home. The worker can then sit at the terminal and perform his work (i.e. process information). Computer terminals come in several types and of wide capabilities.

The simplest is an electric typewriter. The typewriter is plugged into a device (about the size of a shoe box) called an acoustic coupler. The user simply dials the number of the computer using any ordinary telephone anywhere. When the computer acknowledges the call by a high-pitched sound coming over the receiver the user places the receiver in a cradle on the acoustic coupler. The acoustic coupler translates sound into electric impulses or electric impulses into sound. Thus, a person can type in questions using the electric typewriter and they will be transmitted to the computer over the telephone line. The computer can respond over the telephone line and its answers will be typed out on the electric typewriter. Any information which is in alphabetic and/or numeric form can be transmitted to or from the computer or between terminals.

A modification of the above device consists of an acoustic coupler and keyboard combined. The user again dials the telephone number of the computer and puts the receiver on a cradle on the acoustic coupler. The keyboard is part of the coupler. Two wires go from the coupler and these are attached by clamps to the antenna leads on any ordinary TV set. Instead of typing out information on paper, the acoustic coupler causes it to be displayed on the TV screen. The user's commands or the computer's responses can be displayed. Such a device sells for under $1,000 and can be used to drive up to ten TV screens at one time.

A somewhat more sophisticated version of the TV set called a Cathode Ray Tube (CRT) allows the computer to display visual material. The CRT is basically a TV screen. On it the computer can project graphic, diagramatic or pictorial displays. The display can be in color and in three dimensions. The computer can rotate a three dimensional drawing to give the user views of different perspectives. The CRT is especially useful if it is equipped with a light pen. The light pen is the size and shape of a pocket flashlight or large pen. It has a wire which attaches it to the CRT. Using the light pen, an individual can "draw" pictures, diagrams, blueprints, drawings, charts and other visual displays on the CRT. He can also point the pen at a particular part of a display and have the computer modify it. Such uses of the light pen are already being made.[10]

The final development is the large, flat TV screen. These are already in operation at some universities. They are two or three inches thick but are up to sixteen feet by twenty feet in area. Using a light pen an individual can produce on such a screen a very complicated diagram or "blueprint" of a large, complicated system. It is obvious that with a light pen and CRT anyone whose information output is in the form of visual material could work at home. This includes draftsmen, designers, engineers and commercial artists. A CRT can display any combination of alphabetic, numeric and/or visual information one wishes.

VIII. The Total Electronic Information System[11]

The user could also have the computer transmit to his screen a particular TV program that was on video tape. In this way the individual can have access to a whole library of material which could include not only

books, journals and other publications but video-taped lectures, courses and programs on special topics. The computer will search the library for him and assemble all the material on a particular subject or key word. If the user wishes, the computer will even present the material in ascending order of difficulty so that the user can, in effect, have his own tailor-made course on a particular subject. The computer will present questions on the material to the user. If he passes, it will present new material. If not, it will recycle and present the material again with emphasis on the questions he missed. This would allow scholars to do research in their own home instead of wasting time traveling to and from libraries and searching shelves. It will also allow individuals to retrain or to expand their knowledge in the privacy and convenience of their own home. Finally, it will allow a great deal of education which is carried on in school to be carried on in the home.

One may conclude from the above that an individual might never actually leave such an educational system.[12] The child will start out with elementary lessons via the terminal and as he gets older he will progress to more advanced material, but there is no reason why he shouldn't continue using the system all his life. Trips to school for special help from teachers will probably always be necessary, but as the information system becomes perfected and the teaching programs more sophisticated, these will be infrequent.

A significant advantage of the system would be that any time one library anywhere in the country got a piece of information (whether it be a publication, film, or pictorial display) on their system it would be instantly available to all systems. This is because the information would already be in a form such that it could be transmitted by electronic means.

Thus, all they would have to do is send the information over current electronic systems (cable or microwave) to all other libraries or information centers. Similarly, if a researcher anywhere prepared a video tape or a body of instruction for his computer information system, it could be available to all other systems. A teacher ordinarily spends two to three hours preparing for a one hour presentation. The teacher or researcher preparing a video tape would spend days or weeks. But, it would be worth it because once the material is in the form of video tape and/or computer lessons, the presentation would be available to an audience which would consist of everyone in this country (and later in the world) and would be preserved for all time. If the researcher wanted to later modify it, the video tape could be edited and the new tape loaded into the computer information system. In making such a presentation, the researcher or teacher would need the help of those skilled in the television area (director, artist, camera man, technician, etc.). But because of the size of the audience, the effort would be worthwhile and the product would be a presentation which was far superior to the current lecture.

One can see that such a system would not only directly promote the economic development of rural areas it would also directly promote other aspects of rural development. For example, it could provide an education for the rural child equivalent to that of urban children. All would access and be instructed by the same system. Thus the quality of teaching and the diversity of subject matter would be the same for all whether they are rural or urban residents. If a student fell behind in progress on the system, the computer would alert his parents and the local educational

system. At that point a human teacher could be dispatched or he could be called in for counseling and remedial work.

Such a system could also allow the provision of cultural services to rural areas. This would include a library of video tapes of cultural events, visual displays of art work and adult training in culturally enriching courses or humanistic areas. All this could be in the video tape and memory banks of the computer system and called up and displayed on TV screens in an individual's home.

IX. An Overview of the System

These electronic "highways" are projected as connecting computer terminals in the home to firms in urban areas. The system has been sketched from the computer terminal in the home over cable TV lines to centers in small towns in rural areas. From these centers the information goes by microwave or cables to an urban area. The urban areas would be connected to each other in a national network of cables or lasers.

The last aspect of the system which must be described is the other terminus of the system, the firm in urban areas. The nature of the firm's technical setup was implied above. The firm must have or have access to a computer system. The files of the firm must be in the form of electromagnetic energy in the memory banks of the computer system. Many firms already have computer systems. Others have access to computer systems because they are part of a time sharing system. Firms which are part of a time sharing system have their own private files in the memory bank of the system. The private files of a company can only be accessed using certain

code numbers and words. When an individual "left" one firm and "joined" another the system would be commanded to no longer let his number have access to the files of his former employer. But it would be commanded to let him have access to the files of the new employer.

The functioning of the system is obvious for a single worker but what about a conference or team effort? The cable system can easily allow conference communications. Each individual would have two CRT's in operation. One would display the alphanumeric and/or visual information the meeting would be considering. The other, through the use of split screens would display an image of each of the participants. One can imagine that the future office or work room would consist of a room the walls of which were covered with large flat TV screens. In the center would be a swivel chair and attached to it a keyboard. Each CRT would have a light pen and the keyboard would be detachable and light. The room would be part of the individual's house.

When an individual finished producing his information and had it in the form he wished, he would command the computer to save it in its memory bank. He could later call it up at will for further work, for presentation at a conference or have it stored so that others could call it up and make use of it.

X. Policy Proposals

Having described the system, the next step is to suggest directions to take in order to implement it. These directions can be classified into two groups, the technical and the organizational.

The organizational involves the question of who should organize, own, and pay for the systems. The basic network between urban areas and between urban areas and rural towns is a form of public transportation. All should have access to it. The closest thing to it that now exists is the highway system. One could therefore argue that it should be a publicly built and operated system like the public roads. The cost should be borne by those who use it as the current tax on motor fuels attempts to do for our road system. The absolute size of the cost of building such a network would be very great. But it could substantially relieve the rising volume of traffic and would be cheaper than any conceivable means of adding capacity to the transportation system. Because of the high volume of usage possible, the service charge per user would be very low when the system came into general use. In order to reach this state of higher usage, it would be best to charge each user a rate that would cover cost when these systems came into high usage. This would mean a net loss in operating the system for the first few years and should be borne by the government as the cost of solving the rural development and transportation problem.

In the rural area the system of cable TV wires connecting each home to the center in a rural town could be operated like many similar systems now (cable TV systems, rural electric co-ops or rural telephone companies). For development purposes the system should probably be operated like a rural electric co-op. This would mean government low interest loans at first. The rural information system co-op could, in fact, be operated by the rural electric co-op and the two systems could share facilities whenever possible. One can see that models for organization of the system are easily available.

The technical dimension is also not without previous models. All of the technical hardware (and software) described have been proven technically feasible. The only exception is interfacing the large, flat TV screen to a computer and light pen. (This may have already happened without the writer knowing it.) There needs to be a government-sponsored research and development to do this. A second need is government programs to develop hardware and operating systems which are as cheap as possible. Current technical development programs, of private and government sponsorship, promise the necessary level of cheapness in the foreseeable future. A strong government financed program to develop cheap CRT's is necessary to bring the system into full operation as soon as possible. One is safe in observing that the government programs which have been most successful have been those which aimed at a clearly defined technical goal. Rural development will not be a simple technical process. It will have crucial social aspects. But this country is better at solving technical problems and as much of the underwriting of rural development as possible should be done by technical means. This will make the social problems easier to solve or at least less pressing and intractable.[13]

Many would say that a large number of our problems have been caused by technology. However, what they are actually objecting to is the misapplication of a technology. The problem occurs because no thought was given to the social effects of a technology's being implemented in a certain way. What is needed is not less technology but more social scientists willing and able to monitor technological change. This implies that they must study a developing technology before it is implemented in order to

project its harmful and helpful effects. Then they must suggest modifications in the implementation of the technology such that the helpful effects are amplified and the harmful effects are minimized. In order for their suggestions to be implemented the social scientists must make them before the technology is introduced and thus they must study future expected technological changes.

XI. Summary and Extra Advantages

It has been argued that providing jobs for rural residents is a very effective strategy for rural development and that these jobs are provided, with difficulty and expense, by attempting to attract firms to rural areas or by having rural residents commute to jobs in urban centers. An alternative approach was proposed. This approach makes use of an amalgamate of various electronic technologies. This amalgamate is referred to as the total electronic information system and is viewed as an electronic transportation system for information. This alternative depends on two conceptualizations. One is the distinction between jobs and firms. The other is the assumption that many jobs can be viewed as consisting basically of information processing. A corollary is that information may be in letters and numbers and/or visual form.

Two points should be made in conclusion. First, one should observe that all workers in a rural area do not have to work through the total electronic information system. All that is required is for some workers in the area to perform jobs which produce products that are sold outside the area. The rest of the workers will earn their living by providing

local, consumer services, to those who produce for outside sale. This is the multiplier effect applied to a local economy.

Second, one should observe that there is a danger to achieving rural development by attracting a firm to move to a rural area. The population density of a rural area may be so low that its employment needs can be provided for by a few firms. Alternately, it might attract one large firm and become a one company town in effect. If either of these happens and one firm goes bankrupt or moves, then the unemployment problem is serious. A large percentage of the local labor force is unemployed. Their chances of finding other jobs locally are very slim until another firm is attracted in. But with a total electronic information system, even if all the workers do happen to work for one firm (which is highly unlikely and not necessary) and that firm goes bankrupt, they can simply apply for a job at any firm located anywhere in the country. A national employment service is an easy thing to add to the total electronic information system. And when a worker got his new job, he need not move. His changeover is accomplished inside the memory banks of the total electronic information system.

FOOTNOTES

[1]This paper is a projection of certain developments and opportunities, given the current state of electronic technology. It is not an analysis of specific data or the testing of a specific hypothesis. The author would like to acknowledge the kindness of his colleagues Snow White, Sue Richardson, Wayne Oberle, Arthur Cosby and Ray Billingsley in reviewing the first draft of the paper. The assistance given by Bonnie McConnell was particularly helpful. The opinions expressed are, however, the responsibility of the author alone.

[2]A good discussion of the meaning of the term "development" is given by Oberle (1972).

[3]If economic growth occurs and it has no detrimental effect on other aspects of life quality, then the result is an increase in total life quality. That is, if one aspect increases and the others stay the same, then the total of all aspects must increase. There is, however, an obvious potential conflict between economic growth and environmental quality. If economic growth has a detrimental effect on the environment then the net effect of economic growth is not obvious. It will depend on the preferences of those in the area for income and for environmental quality.

[4]Economic growth is particularly strategic because by improving it one may also indirectly improve the other aspects of life quality. (See the discussion on page 2.)

[5]Viewing information as an economic product and as being the most appropriate and/or typical product for electronic technology is not original with the author. Several others hold this or similar views. Some of these include McLuhan (1964: 24, 38, 48, 57-63, 91, 300-311) and Information Canada (1971: 24). Machlup (1962) prefers the term "knowledge". The author prefers the term "information" and in a later paper exploring the economic characteristics of an information/electronic economy will state the reasons for such a preference.

[6]Microwave systems are growing rapidly and several firms are active in building competing systems. For a discussion of this see Lynch (1970).

[7]For example, see Tribus and McIrvine (1971) and Pierce (1961).

[8]The projection is made by the Sloan Commission on Cable Television (1971: 39).

[9]A good summary of various cable TV potentials is given by Knox (1971).

[10]Projections are for a terminal consisting of a CRT and keyboard with some graphic capability and costing $1,000 (in 1970 dollars) to be available by 1985. See Goodwill (1970: 88).

[11]Such a system as is being described here would not only require the development of hardware but would also require the highest quality work by system programmers to develop the software.

[12]The social implications of this, and indeed of the entire system being described, would be substantial to put it mildly. The best elucidation of an anti-technology position, in my opinion, is given by Roszak (1969).

[13]Rural development has both economic and social aspects. But the economic aspects impede the achievement of social goals. Conversely, improved economic performance potentially can help to alleviate non-economic problems. (See page 2.) If the development of a new technology can help solve the economic problems then it can contribute indirectly to solving other problems. Since the U.S. is better at solving technological problems, a good place to start would be the area of technology. This assumes that the technology so developed would have little or no adverse effects. Experience indicates one cannot always assume this, and therefore technological development should be monitored by social scientists. This monitoring should begin long before a new technology is introduced (while it is still being developed). In this way undesirable effects can be anticipated and prevented or lessened. Technically oriented individuals are beginning to express a need for such a monitoring and projection activity by social scientists. For an example see Bowers and Frey (1972).

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